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HYBRID POPLAR GROWS POORLY ON ACID SPOIL BANKS AT HIGH ELEVATIONS IN WEST VIRGINIA

In the early 1950s, a region-wide series of hybrid poplar clonal tests was begun in the Northeast to evaluate the performance of 50 selected clones under a variety of site and climatic conditions. The basic test unit was a block of 50 randomized plots—1 plot for each of the 50 clones. In each plot, 16 cuttings were planted at 4-foot spacing.

One of these clonal tests was established by the Northeastern Station in 1951-52 on acid spoil banks from coal strip-mining in northern West Virginia. The spoils where the plantings were made were forbidding sites. Elevation was about 3,500 feet. This windswept mountain country has a cold northern climate, with a frost-free season of about 3 months. The soil material, derived from sandstone and shale, was medium in texture, contained large amounts of coal and rock fragments, and was very compact at the surface.

Two blocks were planted in 1951. Ground limestone at the rate of 2½ tons per acre was applied to the surface of one block at the time of planting; the other block was not treated. In 1952 several additional blocks were planted on the same spoil area. None of the 1952 blocks was limed.

Survival and growth data were recorded annually on the two 1951 blocks for 3 years after planting. Only general observations were made on the 1952 plantings. A final examination of all blocks was made in June 1962. This note summarizes the data and observations.

Results

Survival and growth on the unlimed blocks were poor. On the 1951 unlimed block, average survival for all clones at the end of 3 growing seasons was 20 percent, and average height of the survivors was less than

Figure 1. — The best group of hybrid poplar trees on the unlimed block in 1962 — 11 years after planting.

Figure 2. — A good clone—NE-46 —on the limed block in 1962.

1 foot. Many of the original terminals of the survivors had died, and only weak sprouts from near ground level persisted. Clonal differences were only weakly expressed. Only two clones (NE-41 and NE-43) averaged 2 feet or more in height after 3 years; NE-43 was the better of these, averaging 2.8 feet for surviving stems. The variable soil conditions, so typical of spoil banks, probably had more effect on growth and mortality than did clonal differences. Concentrations of waste coal appeared to be particularly unfavorable.

The lime treatment clearly had a favorable effect on the poplars. After 3 years, survival averaged about 80 percent and height averaged about 1.75 feet. Fifteen clones averaged 2 feet or more tall. Clone NE-41 was best, with a mean height of 3.2 feet. Many clonal differences became apparent the first year, and generally they were sustained thereafter. Heights attained on the limed block, though definitely better than on

unlimed blocks, still were exceedingly poor in comparison with growth on ordinary agricultural soils.

In 1962—11 years after planting—the effect of liming still was evident in both tree growth and soil pH. At a depth of 1 inch, pH on the limed block was 5.2, as compared to pH 4.6 on the unlimed block.

Living trees on the unlimed block in 1962 averaged less than 3 feet tall, as compared to about 4 feet on the limed block. The tallest tree on the unlimed block had reached 9 feet and a diameter (b.h.) of 0.8 inch (fig. 1). The clone could not readily be identified because the pattern of plots on the ground had been erased by the high mortality. The best tree on the limed block was 16 feet tall and 2 inches in diameter; it was a representative of clone NE-44. Other good clones on this block were NE-41, -42, -43, -46 (fig. 2), -47, and -52. These clones are all hybrids of *Populus maximowiczii.*

In general, survival and growth of the 1952 plantings were about the same after 10 years as described above for the 1951 unlimed plot. However, there were a few instances of markedly better growth that undoubtedly reflect more favorable micro-sites. In one plot, a row of clones planted near the headwall in a moist depression showed much better growth. Several trees of clone NE-42 in this row were 25 to 30 feet tall and 3 to 5 inches in diameter.

In another plot, several unidentified clones showed fully as good growth in 1962 as any clones on the limed plot. These better-growing clones were not in moist depressions; on the contrary, they were on high areas of a somewhat undulating plot. Yet in the same plot there were other areas where no cuttings survived. Apparently the soil on this plot was extremely variable.

Discussion

Lack of moisture and excessive soil acidity appear to be at least part of the reason for the poor development of hybrid poplar in these plantings. The high winds and the stony soil conditions doubtless contribute to the moisture deficiency. Rainfall, which is more than 60 inches a year and well distributed, would be adequate on more hospitable sites.

Compaction of the spoil material probably was another adverse factor. Fresh, loose spoil, if not excessively acid, very likely would have been more favorable than the highly compacted material of the test sites. Soil aeration and water infiltration undoubtedly would be better in looser material, and these conditions would promote more extensive root growth. Although not proposed as a practical measure, we may reasonably specu-

late that loosening compacted spoils by mechanical means, with incorporation of lime to a depth of 10 to 12 inches, would greatly improve them as sites for poplar growth.

Several comparisons with other species further emphasize that the hybrid popuars are not well suited to the test site:

Red spruce.—This native species, which once clothed West Virginia's high mountain sections with thick vigorous stands, was planted in 1950 on parts of the same spoil area as the poplars. Although a relatively slow-growing species, red spruce from that 1950 planting on and near the 1951 unlimed poplar plot averaged 4 to 5 feet tall—definitely taller than most of the poplars. Survival of the spruce appeared to be good. Despite rather poor color in many trees, indications were that they will continue to grow.

Black and pin cherries.—Scattered trees of these native hardwoods have seeded in naturally on the spoils and generally are growing considerably faster than the poplars.

Poplars on other sites.—Hybrid poplars planted on good bottomland soil at 1,900 feet elevation, only a few miles from the mine-spoil planting site, have grown far better than those on the spoils. Some of the same clones as those on the spoils averaged more than 50 feet tall and 6 inches in diameter at 11 years of age.

Not only was survival and growth of the poplars disappointing on the spoils; but also the trees failed to produce any semblance of a litter or humus layer, and they did not provide enough site protection to encourage native herbs and shrubs to seed in. In most places on the plots the spoil surface in 1962 appeared as bare and desiccated as when the poplars were planted 11 years before.

It remains an open question as to whether hybrid poplars might be recommended for planting on coal-mine spoil banks at the higher elevations, if the material were not notably compacted. But for highly compacted spoils at the higher elevations, such as the test sites here described, this study clearly demonstrates that these poplars should not be planted for revegetation purposes. On such sites, they offer no promise for production of wood products and provide but little site protection.

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